ABC Toy Dolly
Reimagine the definition of PLAY

CM Provocation 2

Steffan Cross, Lili Dai, Yani Mai, Mimi Shalf, Arnold Yeung

Abstract

ABC Toy Dolly is a modular toy dolly based on children's toy dollies and furniture dollies that encourages creativity and collaboration in group games. With embedded sensors, LED Lights, magnetic connectors and an accompanying app, ABC Toy Dolly can provide a wide range of games and help reimagine the definition of play.

Multiple games and configurations can be chosen through the app, and are represented by different colors of LED lights on the bottom of the dolly. Some games we planned for the dolly were Blob Tag, Space Invader, and Freeze Tag. The sensors are embedded in the side of the dollies and when two dollies connect the sensors can trigger the lights to change depending on the game being played. Players can also use the magnetic connectors to create different configurations and come up with new games to play.

Design Goal

Our goal was to create or improve on an object that could be used in group contexts and encourage creativity, collaboration, and fun between the people who played with it.

Inspiration + Research

We were inspired by toy dollies that Arnold and Steffan played with in gym class. We enjoyed the aspect of both control and lack of control the dollies had, and wanted to improve the experience for kids using them.

We learned from Chris and from personal experiences that children really like to try to link up the dollies to play as a group. We also looked into adult group bonding games, to get a better idea of collaborative games.
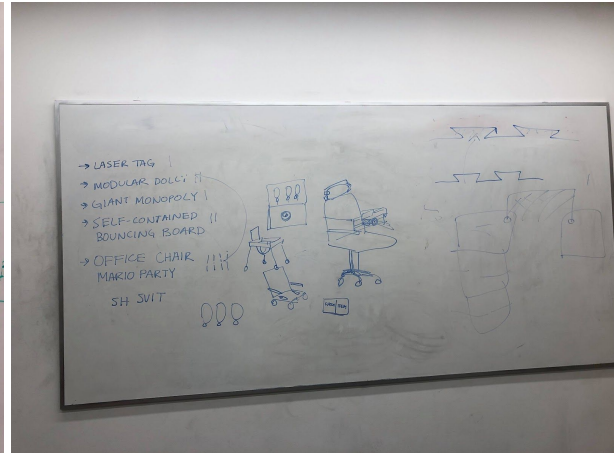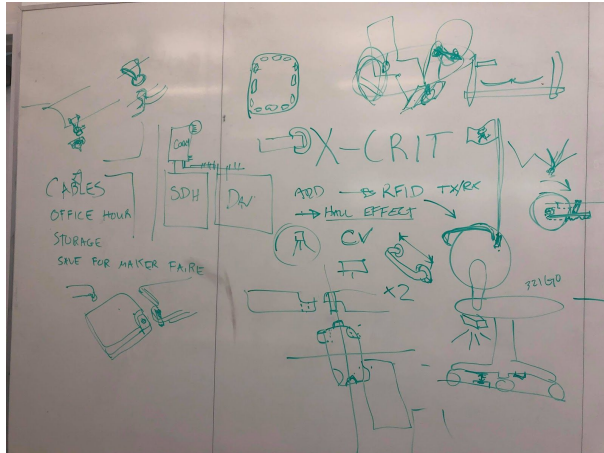

Human Hungry Hungry Hippos

We noticed that a lot of digital or board games were being translated into group bonding games, such as Hungry Hungry Hippos. We wanted to incorporate the ability to play these kinds of games into our project as well.

Concept Ideation

We started our ideation with the idea that we wanted to make something that was fun, physical, and had the nostalgic elements of things we played with during childhood. We decided on the dolly because it was the easiest and most accessible, and we would be modifying something that was already well-known and used.
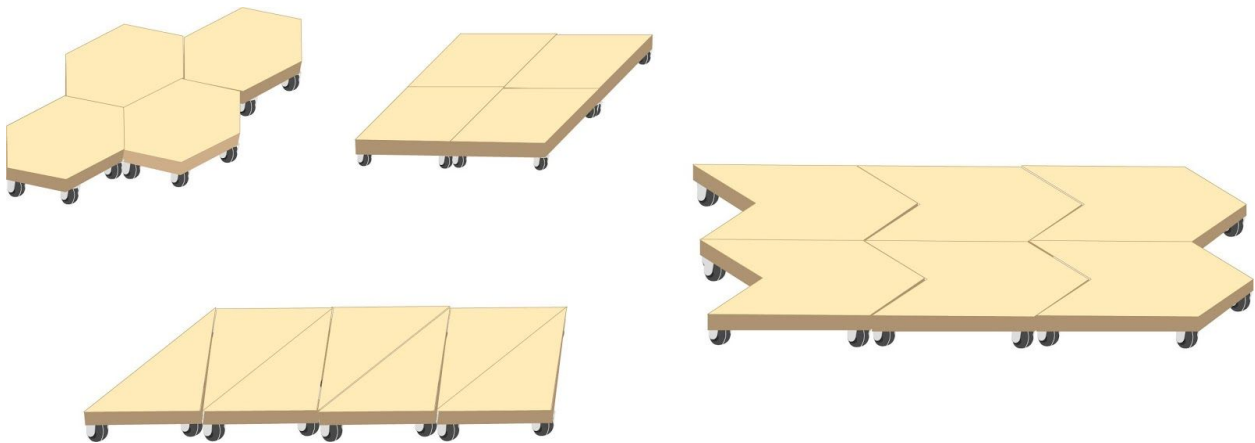
Ideas for modular dolly shape

Features

Modularity

We had several ideas for how we could make the dolly modular, mainly thinking about different shapes that would have connections like a puzzle. However, we decided to use magnets and keep the classic boxy shape because we didn't want to

add more corners to it than it already had, and the magnets more easily allowed connections on all sides.

Light-Changing LEDs and Sensors

We added light-changing LEDs to create a cool visual aspect, and a sort of exciting "reward"/goal for children playing games -- e.g., trying to get the LEDs to change color by connecting the boards.

Interior Handles

We didn't want little fingers to be crushed by bumping boards or impede them as they linked up. As a result, we added handles that could be held so that hands would not be on the exterior edge.
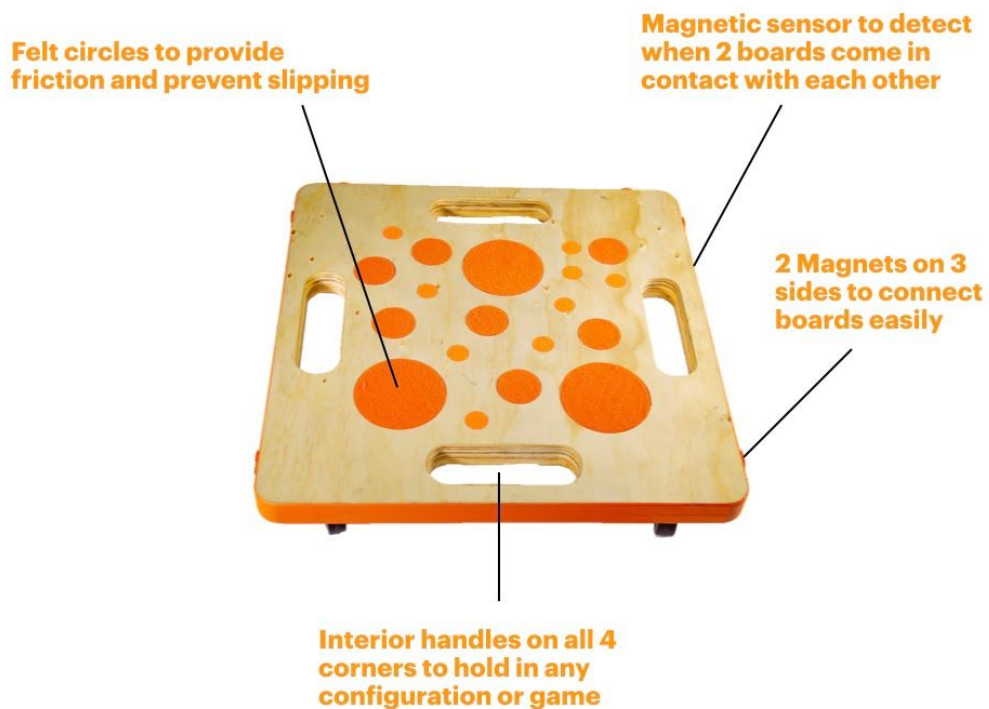
Felt Circles

We added felt circles to provide friction and prevent players from sliding off the boards when scooting around.


App

[Prototype](#)

The app allows remote configuration of games, instructions for how to set up, and how many dollies are needed.

Felt circles to provide friction and prevent slipping

Magnetic sensor to detect when 2 boards come in contact with each other

2 Magnets on 3 sides to connect boards easily

Interior handles on all 4 corners to hold in any configuration or game

ABC Toy Dolly Features

Our Prototype

For the purpose of our prototype, we had two kinds of board: a tagger board and two taggie boards. The tagger board (blue) had sensors on two sides, and when activated for our demo game would be designated as "it" by red LED lights. The taggie boards had only one sensor each, and would have blue LED lights until "tagged" by the tagger board, by when the lights would turn red as well.
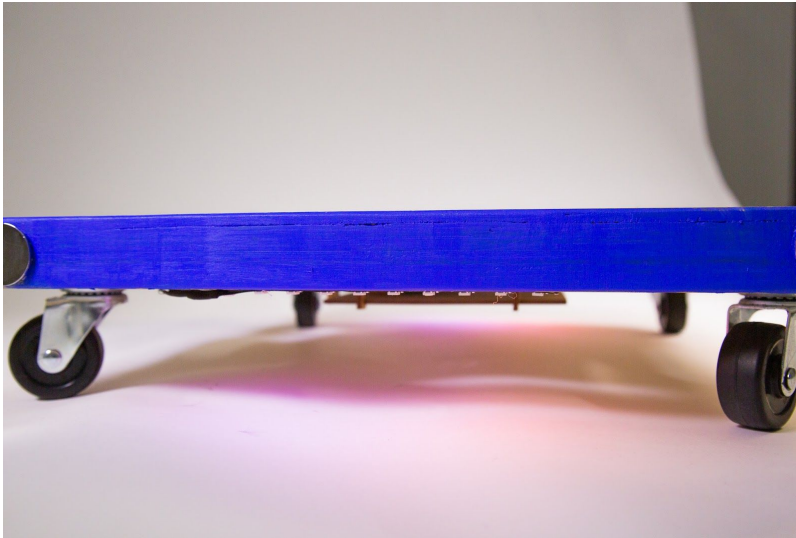
LEDs at the bottom of our tagger board

In addition, because we were storing our electronics on the bottom of the board, we laser cut a [protective covering](#) that could be slid in and out as needed.
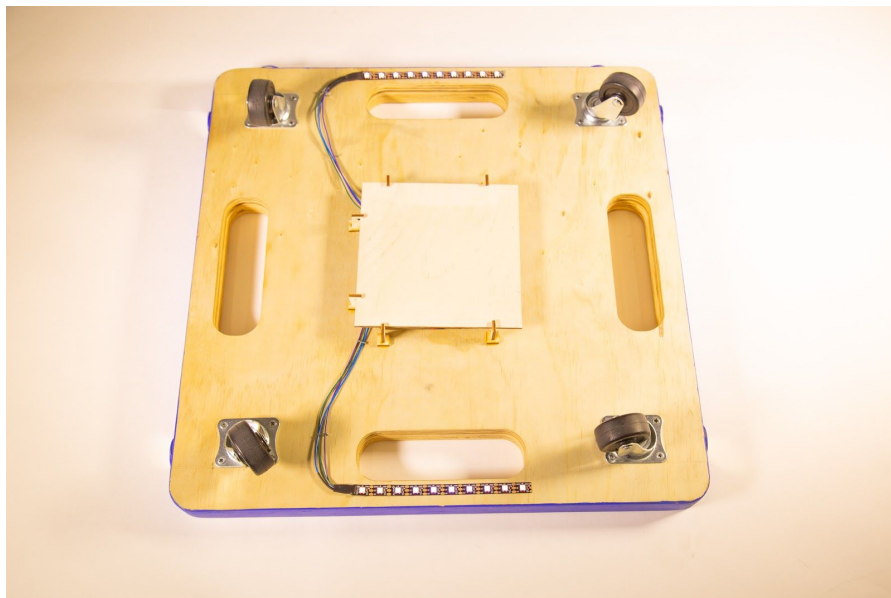
The bottom of our board

Configurations

Here are a few of the modular configurations we came up with for the ABC toy dolly.

ABC Toy Dolly Instructable

Materials required for one ABC Toy Dolly

- Body
  - Plywood (20" x 40" x 0.75")
  - Four 2" Caster Wheels
  - Sixteen ⅝" Screws
  - Eight 1.5" Diameter Neodymium Magnets
  - Acrylic Paint
  - Felt Circles

- Electronics
  - Breadboard
  - Bluefruit Feather M0
  - 3.7v LiPo Battery
  - LED Strips
  - Four Magnetic Sensors

- Assembly tools
  - Power Drill
  - Staple Gun
  - Hot Glue
  - Sandpaper
  - Orbital Sander
  - CNC Router
  - Solder iron
 - Laser Cutter
  - Wood Glue
  - Wood Stain

1. Each dolly measures 20" by 20" and has a depth of 1.5". The first step is to cut out the top and bottom halves of the dolly from the plywood sheet. We used a CNC router but a jigsaw and drill would also work.
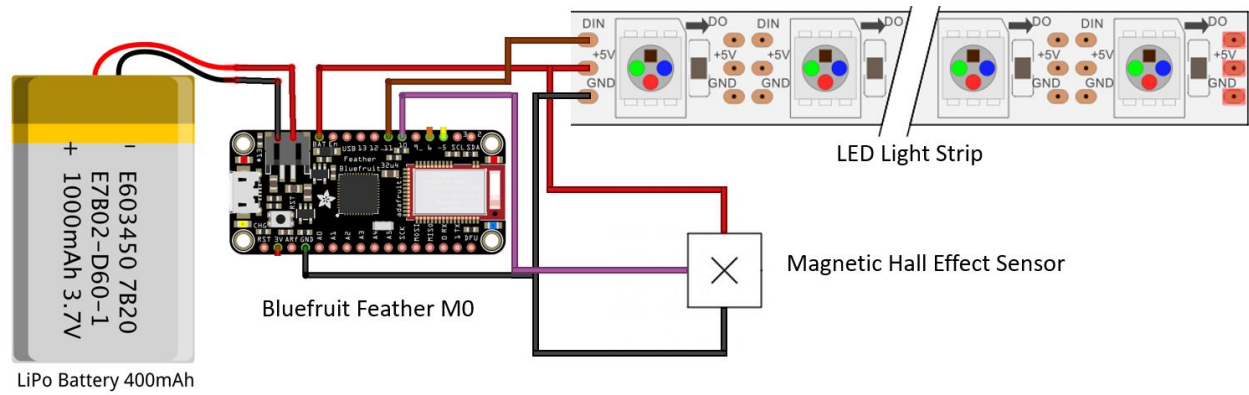

2. After the pieces are cut, attach them together with wood glue and clamp it them down to set. Once the glue has set, sand down the sharp edges on the outside of the boards, as well as the interior handles. Then use wood stain to cover the boards and give them a nice finish.
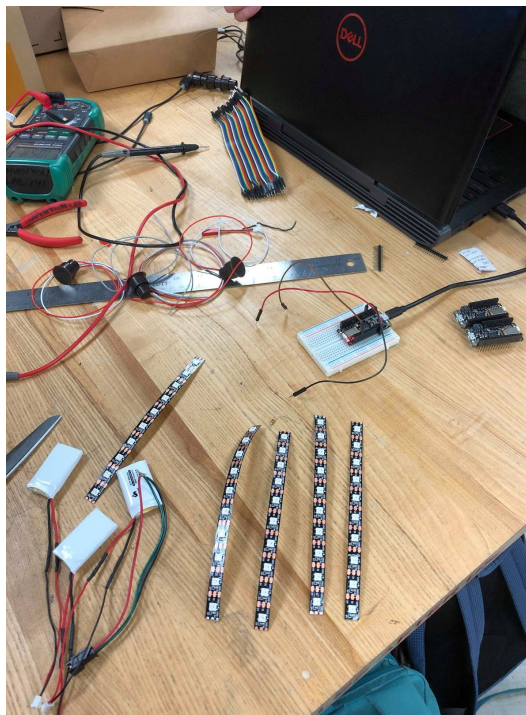
3. To finish with the assembly of the dolly body, attach the four caster wheels to the bottom with screws at 1.5" from the edges. Also, drill holes in the side and insert the sensors and magnets.
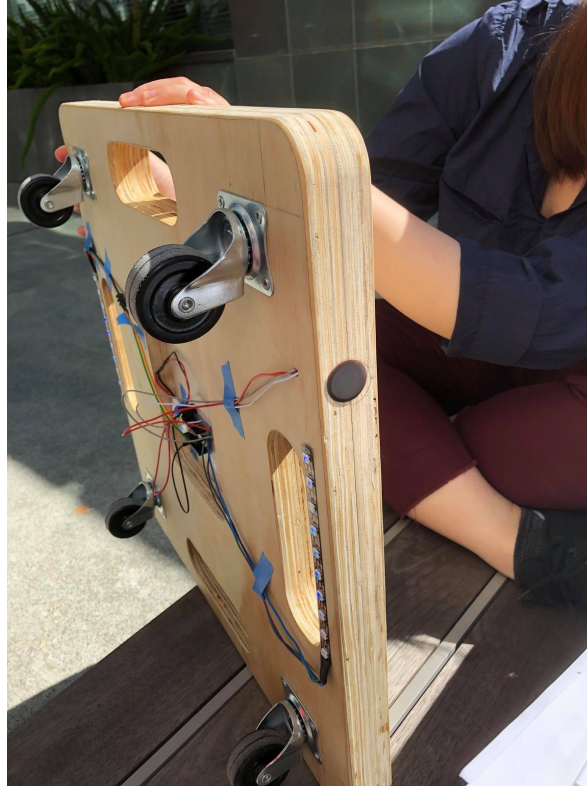
4. Moving onto the electronics, this board has magnetic hall effect sensors that trigger when the boards connect. This signals the lights to switch depending on the chosen game mode. We used the Bluefruit M0 Feather board to control everything as well as link to the app via Bluetooth. The Feather board was inserted into a breadboard and then all the wiring from the sensors as well as the lighting was linked into that. We used a staple gun to secure the wires from the sensors to the underside of the board.

LED Light Strip

LiPo Battery 400mAh

E603450 7B20
E7B02-D60-1
1000mAh 3.7V

Bluefruit Feather M0

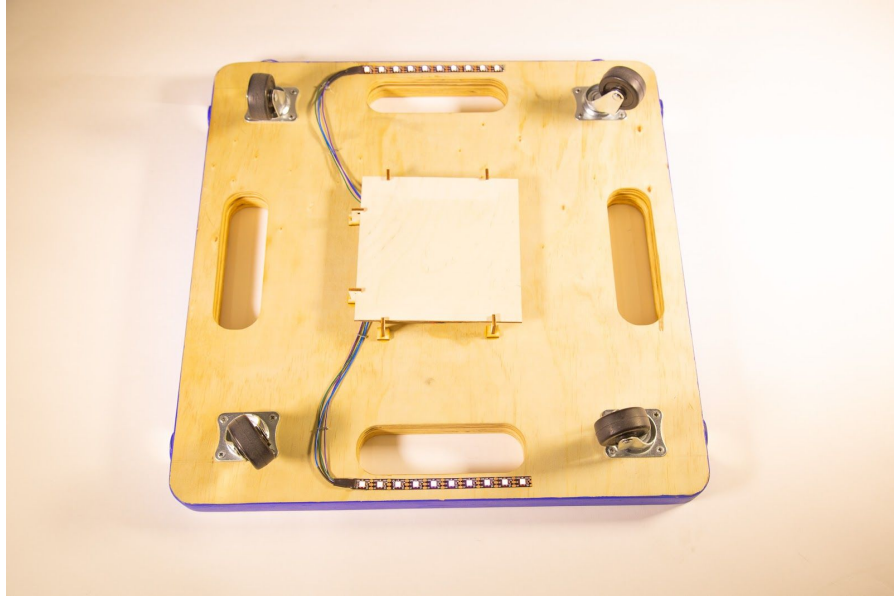### Magnetic Hall Effect Sensor

Wiring Schematic

5. To cover the exposed electronics on the bottom of the board, we laser cut a series of small notches and plate which could be slid in and out to gain access to the electronics.

6. Lastly, as an aesthetic touch and safety concern, we added felt circles on top and painted the sides accordingly to match. The end result should look something like this!

Files

CNC Router file (for the board)
Electronics Cover Laser Template
Tagger (Bluetooth) Arduino Code
Taggie Arduino Code